

Remarks

The present application has been reviewed in light of the Office Action dated August 1, 2006. By the foregoing amendments, claims 4, 5 and 11 are amended. No new matter is added by the amendments, and supports for the amendments can be found from throughout the Specification, Drawings, and Claims as originally filed.

In reply to the Restriction Requirements, Applicants affirm the provisional election made on June 30, 2006. Accordingly, non-elected claims 12-14 are canceled without prejudice by the foregoing amendments.

Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite. In particular, the Examiner has stated that it is unclear which of the reactions, among three reactions, that comprise the method of claim 1 the recited solvent is intended for.

By the foregoing amendments, claim 11 is amended to specify the particular reaction to which the recited solvent is to be applied, namely, "the solvent of the biuret". Supports for this amendment are found, for example, from page 14, second paragraph, which discloses that "As a solvent of the reactant (biuret) or of entire reaction system, water can be used." Accordingly, Applicants submit that claim 11 now satisfies the requirement under 35 U.S.C. 112, second paragraph.

Claims 1-4 and 6-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (WO 01/49652 A1) in view of Olin et al. (US 2,370,065). Claims 1-2 and 4-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (WO 01/49652 A1) as applied to claims 1-4 and 6-11 above, and further in view of Garbo (US 2,524,049).

The present invention is directed to method for preparing hydrazodicarbonamide, and claims 1-11 as amended each require to comprise among others the following three steps of: (1) obtaining biuret of Formula 1 (of which formula as particularly recited in claim 1) and ammonia by pyrolysis of urea; (2) obtaining metal monohalobiuret salt of Formula 2 or 3 (of which formula as particularly recited in claim 1) by reacting the obtained biuret with metal hypohalogen compound or with halogen and base; and (3) reacting the obtained metal monohalobiuret salt with ammonia including ammonia which is produced from the urea pyrolysis process, and the mole ratio of the metal monohalobiuret salt and the total ammonia is 1:1 -1 :1000.

As recited, claims 1-11 of the present invention each require recycling of the same ammonia which is obtained by the pyrolysis process of step (1). In the hydrazodicarbonamide (HDCA) synthesis process from biuret (step (3)), the ammonia produced from the urea pyrolysis process is consumed to provide the HDCA. Therefore, in the present invention, it is not required to supply additional ammonia in the HDCA synthesis process. As a result, the present invention as claimed in claims 1-11 produces hydrazodicarbonamide (HDCA) economically, environmental friendly, and efficiently as a continuous process, while recycling the ammonia obtained from the pyrolysis process (step 1) performed previously.

Lee et al. (WO 01/49652 A1) discloses a method for producing hydrazodicarbonamide using biuret as a starting material. Lee et al., however, is absolutely silent as to the process of obtaining biuret and ammonia by pyrolysis of urea utilizing it as a starting material. According, Lee et al. fails to disclose or teach, among others, the above-identified step (1) of the invention as claimed.

Moreover, Lee et al. further fails to disclose or teach that the ammonia produced from the urea pyrolysis process (step (1)) is consumed to provide the HDCA, as

required step (3) of the present invention. Instead of consuming the ammonia produced from the urea pyrolysis process, the Lee et al. process requires supply of additional ammonia to produce the HDCA, thus, is not economical and environment friendly.

Olin et al. (US 2,370,065) is directed to a process of converting urea into biuret by heating the urea. According to Olin et al., hydrocarbon gas is used for sweeping ammonia formed by condensation of urea to form biuret from the zone of reaction. Accordingly, the object of the Olin et al. teaching is just the removal of ammonia in order to obtain such biuret with high yield. As such, there is not any reference to the use of the ammonia produced from the urea pyrolysis process, as one continuous process, as required by steps (1) and (3) of the present invention.

Garbo (US 2,524,049) is also directed to a process of converting urea into biuret by heating the urea. According to Garbo, a catalyst is used for accelerating the urea pyrolysis process. Similar to Olin et al., the object of the Garbo teaching is just the removal of ammonia in order to obtain biuret. As such, there is not any disclosure in this reference to the use of the ammonia produced from the urea pyrolysis process, as one continuous process, as required by steps (1) and (3) of the present invention.

Accordingly, in view of the foregoing, the present invention as claimed in claims 1-11 (in particular that ammonia which is produced from the urea pyrolysis process is consumed in the subsequent HDCA synthesis process) is neither anticipated nor taught by Lee et al. in view of Olin et al. or Garbo. Therefore, claims 1-11 as amended are patentable over the references of record.

Claims 4 and 5 are amended by the foregoing amendments to particularly point out the subject matter of invention and further distinguish over the cited references. In particular, in order to efficiently remove ammonia for subsequent use in the HDCA

synthesis process, the invention as claimed in claim 4 utilizes inert gas such as air and nitrogen, which is contrary to that Olin et al. uses vapors of hydrocarbons, toluene, naphtha and that Garbo uses naphthalene, kerosene, quinoline, nitrobenzene, chloronaphthalene, etc. Moreover, in order to increase the pyrolysis reaction rate, the invention as claimed in claim 5 uses catalysts such as inorganic acid catalyst (nitric acid, hydrochloric acid, sulfuric acid) and acid type catalyst (thionyl chloride), which is contrary to that Olin et al. does not disclose a catalyst and that Garbo suggests catalysts such as ammonium vanadate, bismuth sulfate, arsenious oxide, tungstic acid, sodium molybdate, etc.

Lastly, Claims 1-4 and 6-11 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-8, 10 and 11 of US Pat. No. 6,635,785 (which is equivalent to Lee et al. discussed above) in view of Olin et al. (US 2,370,065).

As discussed above, the present invention as claimed in claims 1-4 and 6-11 is substantially different from, and thus, patentably distinct over Lee et al. (or US 6,635,785) in view of Olin et al. (US 2,370,065) or Garbo (US 2,524,049). These references, either alone or in combination with one another, fail to disclose or teach the requirements as claimed in claims 1-11 that ammonia which is produced (along with biuret) from the urea pyrolysis process is consumed in the subsequent HDCA synthesis process.

In view of the foregoing amendments and above remarks, Applicants respectfully submit that claims 1-11 are in condition for allowance. Favorable reconsideration and early notice to that effect is earnestly solicited.

Page 10
Serial No. 10/829,418
Response to Official Action

Respectfully submitted,

December 1, 2006

H. J. Park

Hyun Jong Park, Registration No. 59,093
Attorney for Applicants
TUCHMAN & PARK LLC
41 White Birch Road
Redding, CT 06896-2209
(203) 702-7102